

# Effects of global pandemics on hygiene-based contactless logistics in COVID-19 process and the eighth right of logistics: “right hygiene”

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## ABSTRACT

*This study aims to realise hygienic contactless logistic activities to ensure more secure sustainability of logistic movements, in order to protect global logistics from pandemics such as coronavirus disease 2019 (COVID-19) which was first seen in Wuhan, China in the first quarter of 2020. The Industry 4.0 and hygienic contactless logistics has been examined and defined for hygiene-based contactless logistics, a concept that is considered new in logistics literature. During the COVID-19 pandemic, contactless logistics and the eighth right of logistics called “right hygiene” practices will reduce the risk of human-induced diseases and support the sustainability of logistics activities with physical distance between machine and human as the concept of social distance. In the study, the terms of hygiene-based contactless logistics has been introduced into the literature and in addition to the accepted ‘7 Right Principles of Logistics’, an eighth right one called “right hygiene” has been proposed.*

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**Key words:** contactless logistics, COVID-19, pandemic, Industry 4.0, right hygiene

## INTRODUCTION

Since the beginning of the world, unexpected events have always occurred on a global and regional scale. An example of these events is the coronavirus disease 2019 (COVID-19) pandemic, which has recently become the centre of attention and has affected the whole world. Revealing their effects on transportation sector as well as in other sectors, the measures taken due to the coronavirus caused significant contractions. All kinds of economic activities based on contact between people came to a halt, causing serious disruptions in the global supply chain. Since the COVID-19 pandemic has deeply shaken the future of the transportation and logistics industry, the sustainability of economic activities by prioritising human health depends on the survival of the logistics sector.

The logistics sector is one of the sectors that experience the negative effects of epidemics first. Triggering the disruption of the global logistics system, epidemics have become

a serious threat to the logistics industry. Hygiene-based contactless logistics has a very strategic importance for meeting social needs and ensuring the sustainability of the supply chain during global epidemics.

In the study, by mentioning the basic understanding of Industry 4.0, the lack of a defence mechanism for pandemic periods has been pointed out and some suggestions have been made. It has been emphasized that the logistics sector, which has a very fragile and sensitive structure, has applications for contactless logistics at the core of Industry 4.0 against possible pandemics in the fictionalised Industry 4.0, but these applications are not aimed at the concept of hygiene-based contactless logistics resulting from pandemics.

## HISTORICAL DEVELOPMENT OF PANDEMICS

Infectious diseases have been an integral part of human history. One of the most prominent features of pre-industrial

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societies is their extreme vulnerability to all kinds of natural disasters. War and famine were less direct causes of death than natural disasters and pandemics [1]. Famine and unhygienic living conditions caused by wars have almost every time led to pandemic diseases. As a result, many epidemic diseases such as smallpox, typhus, cholera, influenza, and plague have emerged throughout history and have deeply affected people's psychology and their demographic, social and economic life. These kinds of epidemic diseases have spread around the world through tradesmen and soldiers and have become a threat to humanity in all historical periods.

Plague has the worst reputation in history books. First seen in Egypt, plague spread to Palestine and the whole world. It hit port cities and coastal cities primarily through sea travel. Especially the cities on the Mediterranean coasts could not get rid of plague, which was constantly carried via sea transportation, and the ships that were thought to be plague-infected were tried to be kept away from the shore [2]. Each ship that was kept away caused significant disruptions to the supply chain of that time by obstructing the regular flow of logistics activities.

The pandemic continued worldwide for a very long time and spread dramatically both via trade routes and wars [3]. The pandemic greatly damaged logistics activities because of spreading rapidly from port to port via sea transport and affecting the whole world in a period of ten years [4].

Cholera originating from India caused significant losses in many parts of the world in the 19<sup>th</sup> century [5]. Especially, the cholera seen in Istanbul is likely to have been transmitted from the Albanian people or from the ports and piers in Garbi Thrace where the soldiers stopped on the way [6].

Although the military personnel were considered to be the victims of the disease during the 1918 Spanish flu pandemic, the disease spread rapidly to the civilian population in America. The war paved the way for the globalisation of this virus [7].

Another type of influenza, known as the Asian flu, occurred in East Asia in February 1957 and caused 1.1 million deaths worldwide by triggering a massive pandemic [8].

Severe acute respiratory syndrome (SARS) first appeared in Guangdong province of China in 2002, and the disease, defined as a global danger, killed 774 people worldwide in March 2003 [9].

Known as swine flu, swine-origin H1N1, a new type of influenza, was first seen in Mexico in 2009 and this pandemic resulted in high mortality rates in a short time [10].

Middle East respiratory syndrome-coronavirus (MERS-CoV), which was detected in camels in the Arabian Peninsula, has become a danger for all humanity due to its potential to become an epidemic [11].

Undoubtedly, every large-scale epidemic in the world has deeply affected the global trade and logistics sector of the

time. While we previously struggled with infectious diseases such as plague, Spanish flu, AIDS, Ebola, and SARS, now we are facing COVID-19 [12].

As a result of the emergence of coronavirus disease in Wuhan, Hubei province of China in 2019, the pneumonia, which attracted great attention not only in China but also in the international arena, turned into a pandemic in a short time and became a threat to the world economy and supply chain. With the slowdown of the Chinese economy, the flow of global supply chains has been disrupted. Contractions have been observed in companies around the world. As transportation became very limited among countries, global economic activities have slowed down, causing panic in consumers, and companies and disrupting the consumption patterns that we are used to and causing anomalies in the market [13]. This situation has led people to look for new ways out to prevent disruptions in existing logistics activities and supply chain.

## THE RELATIONSHIP BETWEEN PANDEMICS AND LOGISTICS

Epidemics are a disaster that drains the human and economic resources of every state. Pandemics have caused serious drops in the human population throughout history, leading to an important loss of production and demand during epidemics. And lack of production and demand directly causes contractions in logistics movements. Therefore, the relationship between the epidemics in history and the logistics requires to be examined directly through population and trade.

The plague epidemic that emerged in the 14<sup>th</sup> century in Central Asia was transmitted to the world through trade [14]. The disease spread by land and sea severely in some regions and slowly in others. The population of the regions and the proximity of the ports and trade routes to the city greatly influenced the severity of the spreading [15].

It cannot be considered that the epidemic affected only the population negatively. The population decline due to the epidemic also negatively affected the logistics activities, having an indirect impact on the economy of that period, and caused economic difficulties.

Periodic losses in the population after the epidemic have led to an increase in the life quality of the survivors in the long term. However, in the short term, it caused a decrease in demand in the economy and caused the logistics movements to contract.

One of the common aspects of all the epidemic diseases is that they spread rapidly through the logistics activities, initially on a regional scale and then on a global scale, and affect the world trade and the logistics transportation, which is the conductor of this trade, in a negative way.

It can be easily deduced that in the historical process epidemic diseases have negatively affected the world trade

and indirectly the logistics sector in the short term. However, a different implication may be considered for the long term. According to the conditions of that time, the plague, which had the highest mortality rate among the mentioned epidemics, Spanish flu and other epidemic diseases, would lead to the death of millions of people, and when considered in the long term, this would cause a massive population loss and consequently a decrease in birth rates, and a decrease in the actively working young population. This logically increases the price of the labour factor. The increase in the price of the labour factor increases the income of individuals. The increase in the income of individuals directly increases the demand for manufactured goods. Long and short distance transportation of goods will increase and so will logistics activities in the long term in order for the goods produced in larger quantities to reach the final consumer as a result of the increase in production due to demand. Epidemics in world history have undeniably deeply affected the logistics sector through world trade and will continue to affect it in the future. In this context, more secure sustainability of the logistics movements of world trade without endangering human health will undoubtedly be very important.

### **THE CONCEPT OF HYGIENE-BASED CONTACTLESS LOGISTICS**

We know that the perceptions of the logistics industry in the market are very fragile and sensitive in the face of sudden epidemics. The International Monetary Fund's claim that the impact of COVID-19 on the world economy may be worse than the Great Depression of 1929 [16] can be interpreted as a sign that the current global pandemic will deeply affect the world economy and undoubtedly the logistics industry in the short term.

A road map and a depth strategy of the logistics sector should definitely be created in possible large pandemics before major fractions turn into earthquakes. The logistics infrastructures of the future production and consumption facilities must be planned and a communication process that is absolutely coordinated with the logistics system must be started. The "hygiene-based contactless logistics" system, which will be one of those opening doors of the future in the logistics sector, must definitely be established and developed.

### **THE CONCEPT OF HYGIENE-BASED CONTACTLESS LOGISTICS**

Logistics contains the purchase of raw materials, the production of goods and their delivery to consumers, and the withdrawal of the products because of reasons such as recycling and spoilage. The concept of hygiene-based contactless logistics is a systematic and sustainable fulfilment process of all the stages above, which are included in all

the supply chain stages, with a contactless transportation network system in order to supply the demanded products directly or indirectly. In fact, the concept of "social distance", which emerged with the COVID-19 pandemic and has become a very popular slogan today, is the hygiene caused by the distance range put by human to human, in other words, the hygiene caused by the contactlessness based on the distance between the "machines and people" actively working in the production and logistics process in industries. The basic philosophy of the hygiene-based contactless logistics process in which there is no or minimized human intervention is that the less contact means the more hygiene.

For today's people, it is an undesirable situation for them not to be able to meet their most basic needs due to the lack of health services, the disruption of production activities and the broken supply chain. The political power in each country should concentrate on emergency action plans to keep production activities and supply chain uninterrupted due to the epidemic. This is because the cessation of production and supply chain will directly hit the economy and consequently the logistics sector. There is no logistics in a place where there are no production activities. In this case, it can be stated that the logistics sector, which is in communication with different sectors, is directly affected by the current epidemic.

Although the virus seems to concern health sciences more, it is actually the tip of the iceberg. Its effects on sociology, economy and logistics, in other words, its effects in socio-ecological aspects, will be deeper in the invisible parts of the iceberg. In this respect, in order not to digress from the main subject, the subject will be expanded by focusing on hygiene-based contactless logistics only through the logistics dimension.

### **THE PROCESS OF HYGIENE-BASED CONTACTLESS LOGISTICS**

The process of hygiene-based contactless logistics, unlike that of the traditional logistics, is a logistics process that aims to eliminate human contact during the process from the starting point of the raw material to its delivery to the final consumer and from them to the producer again.

In the COVID-19 pandemic, workers in transport sector rank first among those who are potentially at risk. To illustrate the connection between hygiene and all kinds of action chains in which human beings are actively involved such as cargo delivery workers, motorcycle couriers, maritime/airline/railway and harbour workers, it can be stated that the human factor being at the maximum level during epidemics that endanger human health will increase the contact, which will cause a decrease in the hygiene level. In this case, it would not be wrong to suggest that there is a negative interaction between human and hygiene.

In short, the primary goal of the hygiene-based logistics process is to add the hygiene factor to the logistics process in order to ensure the protection of human health by eliminating any kind of human-based contact via the contactless production, packaging, loading-unloading, transportation, warehousing, delivery and paperlessness, and to ensure that the logistics processes are carried out without contact.

### **THE PROCESS OF CONTACTLESS PRODUCTION**

Production is the name given to all activities made to produce goods and services that will meet the needs directly or indirectly [17]. In the process of the hygiene-based contactless logistics, the contactless production process supports the elimination of the human factor and ensures production through intelligent robots with artificial intelligence, whose use will increase day by day with Industry 4.0.

### **THE PROCESS OF CONTACTLESS PACKAGING**

Packaging of the manufactured products is a very important stage in terms of hygiene. At this stage, minimising the human factor and even eliminating that factor in this process will increase hygiene.

### **THE PROCESS OF CONTACTLESS LOADING-UNLOADING**

Loading can be defined as transferring the raw material or the manufactured product to the transport vehicle or into a container with the necessary equipment; and unloading is, as the opposite of loading, to take the loaded products out of the transport vehicle or the container which contains the products. Loading and unloading operations are included in the entire logistics process. For example, the simplest example of this situation is that after the raw material is loaded on the vehicle, sent to the manufacturer and unloaded from the vehicle, the manufacturer also reloads the product he produces in the same way to deliver it to the final consumer and the buyer performs the unloading. The presence of human factor during the loading-unloading stage poses a serious threat in terms of hygiene.

### **THE PROCESS OF CONTACTLESS TRANSPORTATION**

Transportation is defined as the delivery of a good from the place where it is produced to the desired place as required and as making a planned, efficient, fast and safe transportation [18]. The point to be noted here is safe transportation. Safe transportation actually ignores the hygiene factor while involving safe, undamaged and efficient transportation of products. However, unhygienic transportation will seriously affect human health and destroy the trust factor.

### **THE PROCESS OF CONTACTLESS WAREHOUSING**

Warehousing is briefly a logistics activity that aims to stockpile the products transported between the producer and the consumer [19] and to deliver the stocked products on time to the relevant place as quickly as possible [20]. Although human contact is less than other activities in this process, it is still an activity that needs attention.

### **THE PROCESS OF CONTACTLESS DELIVERY**

The purpose of a logistics process is to produce the requested product and deliver it to the end user. As in other stages, the main goal is to eliminate contact between human and product. Today, there are some studies on "Contactless delivery and Contactless shipping". For example, while some cargo companies have minimised the contact factor by switching to the delivery system with the SMS code, some cargo companies are working on drone delivery to completely eliminate contact.

### **PAPERLESSNESS**

Today, with the development of technology, there have been changes in all areas of trade. Of course, the technology used in logistics has also adapted to this situation, and all documents used in trade and transportation have been transferred to the electronic environment. In the pandemic environment we are facing today, considering that the sector employees avoid contact as much as possible, it will be healthier to process the paperwork in electronic environment based on hygiene-based contactlessness.

### **THE RELATIONSHIP BETWEEN CONTACTLESS LOGISTICS AND INDUSTRY 4.0**

The fourth stage of the industrial revolution is characterised by the introduction of "cyber-physics systems" in factory processes. We are in a period when these systems will be combined in a single network, be in a real-time communication with each other, configure themselves and learn new behaviours. Such networks will be able to produce accurately with fewer errors, interact with manufactured goods and, if necessary, adapt to new consumer needs [21].

These products are distinguished by sensors that provide feedback to the production system, identifiable components and processors that carry information to convey effective guidance to customers [22]. Industry 4.0 presents the logistics systems that the whole world needs, especially in today's conditions. New production and information technologies aim to draw humans away from human-oriented production and logistics activities to a large extent, just as we wish, although not completely for now. It creates a competition by taking the labour power, which is among the large population of the east, from the countries providing cheap labour, while minimizing the use of labour, which is

one of the factors of production in the economic sense. While this competition was achieved, they were not aware that they were preparing for an unexpected epidemic in the 4<sup>th</sup> industrial revolution. It is obvious that it is vital to minimize the use rate of the labour factor both in production and logistics in order to prevent the spread of COVID-19, which is an epidemic that is sweeping the world today, and similar epidemics. Companies that implement hygiene-based contactless logistics in the period of Industry 4.0 will gain a significant competitive advantage. Firms that fall behind this competition will have difficulties to survive as they will lose their competitive advantage in the future.

In this period, when people are struggling with a rapidly spreading epidemic on a global scale, the necessity of the transport systems that can make autonomous decisions, the digital supply chain and the hygiene-based contactless logistics is obvious. It can be easily predicted that the process of hygiene-based contactless logistics, where human intervention is minimized, will prevent the spread of epidemics. However, it should never be forgotten that the human factor planned in Industry 4.0 should never be completely eliminated in the processes of hygiene-based contactless logistics and production. In the third industrial revolution, man was a mere means of production such as machinery, raw materials and capital. With the digital or fourth industrial revolution, the labour factor is in the process of being gradually removed from the production and supply chain. Although there is no problem in terms of transition to a more prosperous world order by providing the needs of a rapidly increasing world population in a faster and contactless environment, if we evaluate the situation with a Malthusian (Thomas Malthus) approach in terms of historical process with reference to the idea that human population increases geometrically and goods and services increase arithmetically, industrial revolutions have always emerged as a search for a solution. In other industrial revolutions, the human factor was never removed from the production and supply chain. However, with Industry 4.0, which we call the fourth industrial revolution, the labour factor is gradually removed from the production and supply chain, but a solution for where and how people will be employed in the increasing world population has not been offered. Moreover, it should never be forgotten that the world population, who was left unemployed with the exclusion of people from the production and supply chain, consists of those who demand goods and services that are produced and distributed without people.

A formation without those who demand will bring about social anarchy in the long run. No matter how much we provide the most perfect, most flawless, and healthiest goods and services, an unmanned world economy is unthinkable. Man is not an unidentified means of production. Let the

people live so that the economies live, and the civilizations live. With Industry 4.0, people are trying to create heaven in this world, but what should not be forgotten is that paradise without people becomes meaningless.

The service types demanded from logistics, which is one of the leading sectors affected by Industry 4.0, are also diversified with the digitalization of industrial processes [23]. Especially with the rapidly developing technology revolution in the last century, the life of the products has been shortened. The advancing information technology has introduced the digital information economy. The shortening product life curves on a global scale caused the production to be transportable all over the world. This complex production system required new logistics and supply activities [24].

Logistics enterprises have to use high technology to continue their activities and compete during epidemics. The logistics sector has started to use many technological developments such as unmanned aerial vehicles, smart robots, autonomous vehicles, cloud computing, three-dimensional printing, face and voice recognition technologies, bionic robots, and big data analytics [25]. All the political authorities seeking the best in production, trade, politics, health and logistics around the world are paying a heavy price to get out of this difficult process that we are going through [22].

Changes in global trade are mainly due to economic, technological, political and natural factors. In economy, countries can increase or decrease their footprint through goods and service analysers or import markets. Technological innovations can increase the country's footprint and improve the cost and effectiveness of global trade. In addition, the ideology adopted by governments has influenced trade-related policies, shifting from more open to more protective trade policies. Recently, firms are challenging another type of global change that has the threat of spreading the coronavirus called COVID-19 [26]. Cargo companies, in particular, continue to deliver the manufactured products to consumers. In a sense, companies that understood and developed Industry 4.0 survived in the face of a sudden epidemic. We are experiencing a process in which logistics companies must be ready to serve within the framework of the necessity of Industry 4.0. With Industry 4.0, industrial organizations use natural resources more efficiently and reduce the damage they cause to nature. New ideas and inventions are implemented quickly at much lower costs. However, we believe that the logistics sector, which is very fragile and sensitive in the face of epidemics, does not intend to create a conscious defence mechanism against epidemic diseases in Industry 4.0, although it is planned that production and productivity will be directly proportional to the idea implemented, not to muscle power.

Although the basic understanding of Industry 4.0 is to increase the quality of life of people based on high tech-



nology and innovation and to increase productivity with low costs by providing superiority against competitors with the latest technologies, an important factor that will be a serious threat for itself has unfortunately been overlooked. Indeed, Industry 4.0 indirectly supports the concept of hygiene-based contactless logistics, since it essentially means reducing the use of the labour factor within the industry. The concept of contactless here is closely related to human health.

Thanks to the developing technology and artificial intelligence, a product that weighs tons is placed on a ship, train, container without human touch, and the location of the vehicles traveling with the transport mode can be traced and monitored with mobile applications. The threats created by such pandemic diseases will be prevented by eliminating the human factor as a result of the widespread use of unmanned trains and aircraft after self-moving trucks in China. Hygiene-based contactlessness will increase in parallel with the dominance of machinery and devices in logistics. These unmanned vehicles will reduce the risk of human-caused epidemics and ensure the sustainability of logistics activities. COVID-19 has proven to the world that the efforts for contactless logistics can be vital.

It should not be forgotten that we do not think that contactlessness alone and hygiene created accordingly by removing the human factor partially or completely from the contactless logistics process can save people from epidemic threats. However, we are of the opinion that it is the most important actor in terms of solving the problem, although it is not a solution alone. In fact, with Industry 4.0, there is an increase in the need for the human brain, but a decrease in the need for manpower.

## INTERNET OF THINGS

Internet of Things is one of the most popular technologies of today and one of the technologies that companies prefer to invest the most. The Internet of Things enables a safe, measurable and traceable management with opportunities such as real-time tracking of the entire supply chain, barcoding, and the use of vehicle and fleet technologies in the logistics sector [27]. In short, thanks to the Internet of Things named "The IoT", the products will be prevented from falling in freight transportation, and sensors and cameras will be able to detect risks and defective storage and calculate the falling probability of any product. Smart walkways, smart containers, smart warehouse management system, mobile localizations, and robots will change all the qualities of both the job and the people doing this job.

In addition to these, the innovations brought by the Internet of Things will enable the monitoring and visualisation of various wireless sensor applications in production areas such as automatic work cells, transportation sys-

tems, logistics and storage systems [23]. The Internet of Things has revolutionized the logistics industry. The fact that smart devices communicate with each other and act in accordance with the information they receive directly eliminates the intervention of the human factor. We can easily talk about a hygiene-based contactlessness in a system that is unmanned and indirectly that does not involve human intervention.

## INTELLIGENT ROBOTS

The use of intelligent robots in the logistics sector will be an important development that provides the sector with advantage. In this way, physical contact between human and product will be eliminated.

Equipping robots with superior artificial intelligence and making them intelligent and their exhibiting autonomous behaviours will improve operations in the logistics process. Innovations in robot technology are expected to be a highly preferred investment in the upcoming years. Order picking is a challenging phase of logistics operations [28]. The operator collects the products by visiting the shelves where the orders are located, and in order to carry out this process in independent aisles, this not only causes waste of time but also creates a hygiene risk in the products as a result of direct contact with the products. It is possible to overcome this risky situation with robot technology.

The most characteristic feature of Industry 4.0 is making production thanks to smart robots in the sector. As robot technology advances in the world, the cost of robots decreases. With smart robots, technological tools and equipment are produced faster, and the need for human labour is reduced. Although robots are thought to reduce the need for human labour, they will increase the demand for skilled labour in matters such as technical support and software updates for robots.

As the interaction of intelligent robots with each other and their technology increase, the intelligent supply chain will develop with the use of robots at every stage of the supply chain, contactless transportation, storage, assembly and distribution processes will be provided thanks to transport robots moving on a track, and customer satisfaction will increase with a hygienic environment.

## INTELLIGENT FACTORIES

Factories that can easily and smoothly manage highly complex production processes, whose products have a longer lifespan, and where production is made with autonomous robots using the latest technology, are called intelligent factories. With the Industry 4.0 revolution, the first foundations of intelligent factories were laid.

In intelligent factories, people, autonomous robots, machines that can communicate with each other and all other

production factors are in a deep interaction. Within the framework of cyber security, machines that are in communication with each other automatically stop the production when they encounter any problems and seek solutions to fix the problem. In intelligent factories, the realization of just-in-time production with the lean production method becomes a reality with the machines' planning the production resources [29].

The German Research Centre for Artificial Intelligence (DFKI) has developed a prototype called the intelligent factory with various manufacturers. The main feature of this factory is the integration of independent production modules that communicate autonomously with each other thanks to various information systems. People only play a supporting role in the production phase. The improvements are based on three main elements, which are the intelligent communication product, networked systems and assistant operator of the system [30].

With the increase in the number of intelligent factories and advanced automation technology systems, it is predicted that the need for unskilled workforce will decrease [31]. Thanks to the use of machines, robots, unmanned production lines, data and simulation techniques that are in communication with each other, productivity, speed, flexibility and quality will increase in production [29]. Mr. Warren G. Bennis says: "The factory of the future will have only two employees, a man and a dog. The man will be there to feed the dog. The dog will be there to keep the man from touching the equipment." [32]. And this statement wittily heralds that there will be no human beings in the intelligent factories of the future, and production and logistics activities will be carried out in a contactless manner, therefore based on hygiene.

### THE RELATIONSHIP BETWEEN CONTACTLESS LOGISTICS AND INTELLIGENT PACKAGING

Packaging used in the production of basic food and necessity goods is important in terms of hygiene, as well as eliminating contact in a sense and it will ensure that all kinds of logistics movements of these products are made in a safer and healthier way. In this sense, packaging is of great importance in terms of hygiene-based contactless logistics. Incorrect packaging already causes the growth of bacteria, viruses, fungi and most of all, waste. Antimicrobial packaging, also known as active packaging, is one of the newest techniques in the protection of products that are highly susceptible to microbiological deterioration due to their chemistry. Antimicrobial packaging is a longer and more hygienic preservation of the product by providing a controlled release of the antimicrobial agent that is included in the packaging material and atmosphere [33].

The determination of the use of correct and environmentally friendly recyclable packaging in accordance with the laws and regulations will make the process of contactless logistics more effective and active.

### CONTACTLESS LOGISTICS AND THE EIGHTH RIGHT OF LOGISTICS

The purpose of the services provided in logistics is to supply the product needed by the end consumer and to meet the seven generally accepted expectations of logistics in this supply process. This is called "7 Rights of Logistics". The 7 Rights of Logistics (the 7R rule) are fundamental to every logistics system without exception. The purpose of logistics is generally reflected in 7 rules and if these rules are followed, it is accepted that the logistics activity achieves its purpose [34].

1. Right product — First, the kinds of products to be handled and transported must be known. Having the right information will provide the advantage of managing both time and resources in an appropriate and efficient way.
2. Right place — A systematic distribution system and tracking is essential. Also, both the customer and the service provider must have synchronized location tracking to ensure that products are delivered to the right place.
3. Right price — An appropriate price value is essential to keep track of the company's income and expenses.
4. Right customer — The company must define its target market and choose the right customers.
5. Right condition — Any product or item to be entrusted to customers must be stored and delivered in right conditions. This is where specifications should be referred to place the quality where it can be maintained.
6. Right time — Every service provider must know the right time to deliver products and use it efficiently.
7. Right quantity — Knowing and determining the right quantity is essential for the most efficient transportation.

The 7R rule should be applied to all logistics processes available in the services industry, from raw material ordering and procurement, deciding on the right supplier, procurement management and shipping, and to sales and customer services [34].

Just as the effects of Industry 4.0 on logistics have reshaped what we know, it has revealed a reality that should have been noticed much earlier in the COVID-19 process. "Right hygiene", which should be the eighth right of logistics in our opinion, has now become a necessity with the opportunities provided by Industry 4.0 and the COVID-19 pandemic.

Seven basic principles apply in logistics. However, "right hygiene", a 'right' that is unlooked-for or not considered till the COVID-19 pandemic, should be added to these rights, and the eighth right should be taken as reference in en-

suring customer satisfaction. This is because, in the eyes of the customer, the COVID-19 pandemic has shown that no matter how right the first 7 rights are, if the 8<sup>th</sup> right, which is right hygiene, and the products provided from the supply network based on the right hygiene cannot be offered to the customer who is the final consumer and if this perception cannot be achieved on the customer, the other rights become meaningless. Failure to comply with the right hygiene rule during the pandemic process has led to the loss of customers, the disruption of the production cycle and, accordingly, to poor market positions.

The global epidemic of COVID-19 confirms our thesis, and together with the awareness of the world, no matter how right the “right price” application is, which is one of the seven rules of logistics, the point which the customer emphasizes along with the epidemic process is the product hygiene. And in this sense, the right hygiene rule has been observed to be way ahead of the “right price”. Industry 4.0 has a direct impact on all the 7 rights of logistics and the “right hygiene” that we propose as the 8<sup>th</sup> right.

With Industry 4.0, investments to be made for information and communication systems and intelligent warehouse attempts, and other infrastructure needs within the framework of logistics 4.0 should be reconsidered by companies that we can call the pioneers of the sector in the context of contactless logistics and right hygiene, which we define as the eighth right. In addition, developments regarding the adaptation of intelligent systems to the contactless logistics sector should be scrutinised. All developments in the information sector and technology in the world must be integrated with the hygiene-based contactless logistics system in order to supply the product needed by the end consumer, which is the purpose of the services provided in logistics, and to meet the eight rights (8R) expectations in this procurement process.

Every global epidemic on a large scale can be overcome with a global struggle. The hygiene-based contactless logistics and the eighth right of logistics will be one of the most important weapons in this global struggle. In his idea of “creative destruction” [35], characterises this concept as the elimination and replacement of the old one by a new development and innovation emerging in capitalism. It's the best theory to explain the economic and social change. In the context of creative destruction, when a strong new structure or innovation emerges, old structures will completely lose their influence, and new structures and institutions will shape the new era [36]. In this sense, this is the truth that is intended to be expressed in the message within the slogan “nothing will be the same”. “Contactless logistics” and “right hygiene”, which we refer to as the eighth right of logistics, can be evaluated as an opportunity, a change, a renewal for the logistics sector during the COVID-19 pandemic.

## HYGIENE-BASED, CONTACTLESS NEW GENERATION LOGISTICS

Along with unmanned ship transportation, driverless cars, tube and drone logistics, the logistics sector is experiencing an era of unmanned vehicles. While the logistics sector is moving towards taking advantage of these and similar advantages, and increasing productivity by reducing human-induced errors by adapting to this change and development in technology, it also aims to prevent all kinds of disease threats that can be transmitted by human contact with the emerging new generation transportation vehicles.

With the developing technology, transportation vehicles which will be the prominent vehicles of the future such as autonomous vehicles, ships without captains, pilotless planes, driverless trucks, etc. will gain a large place in the contactless logistics process, and deliveries with drones and transport with cargo robots will be actively carried out. As shown by the epidemic diseases experienced in the past and today, human-to-human and fomite contact increases the risk of epidemics and emerges as a factor that seriously affects human health. In this case, in the process of reducing anti-epidemic measures and getting used to the new normal order, it will undoubtedly be everyone's priority to provide the products that people demand with hygiene-based contactless logistics.

## UNMANNED VEHICLES

Starting with unmanned aerial vehicles and extending to unmanned cars, and now getting to work on unmanned ships in the maritime sector [37], technologies aim to eliminate the human factor in transportation. And the logistics industry has begun to experience the era of unmanned vehicles with these technologies [38].

Shipping companies are speeding up their operations on unmanned ships to minimize human errors and reduce costs. The last example of this was Japan-based Nippon Yusen company [39]. Unmanned marine vehicles have many benefits to ship owners, and maritime industry, and in terms of environmental pollution and safety. More energy-efficient use of unmanned ships, easy and reliable operation, and reduction of accidents caused by human error are just a few of these benefits. Additionally, reduction in operating costs and emission use can be given as an example [40].

Autonomous vehicles without drivers are smart vehicles that can analyse in-vehicle information and information from their environment simultaneously using advanced systems, are equipped with independent decision-making capabilities, and can move on land. Self-driving vehicles play an important role in protecting human life by making fewer mistakes. In addition, self-driving vehicles will consume less fuel and cause less damage to the environment with smart driving methods [41].



What is emphasized among the main benefits of every unmanned vehicle is to reduce human-induced errors and environmental damage, and protect human health. What is mentioned here about protecting human health is the loss of life as a result of accidents caused by humans. However, one point has gone unnoticed. People do not only die from accidents. In the epidemic process, the example of which we see very clearly today, the human factor can put their lives and lives of others on the line through contact. For this reason, unmanned transportation vehicles will have an important place in eliminating the human factor in the contactless logistics process.

### **TUBE LOGISTICS**

Traditional means of transport are expensive, slow and environmentally harmful. Traditional transportation vehicles will not seem very advantageous in the future due to the reasons like the damage of carbon emissions, fluctuations in oil prices, speed problems, and traffic congestion [42]. Tube freight transport is an unmanned transport system in which capsules or capsule trains carry freight with tubes between terminals. The system can be thought of as an unmanned train carrying containers in a pipe. High volume loads can be transported by tube freight transportation. With this transportation system, improvement in efficiency, lower freight rates and reduced environmental damage will be observed [43].

Tube logistics has many attractive features for future use. Since these systems are unmanned and fully automatic, they are safer than truck or railway systems. Because they are closed, they are not affected by the weather and are not subject to the most common rail or road accidents [42]. In addition to the mentioned advantages [25], the most important reason for the proposal to use tube logistics in the hygiene-based contactless logistics process is that the transportation is carried out unmanned and without contact. Tube logistics, which eliminates the human factor, will increase the hygiene factor to the maximum level by directly eliminating the contact factor, thus eliminating situations that will put human health at risk, especially during pandemics.

### **DISINFECTION TUNNEL**

The environmental factor is a factor that can be the cause of diseases, affect the course and outcome of diseases, and facilitate the rapid spread of epidemic diseases to people and their environment, as well as laying the groundwork for the formation of diseases [44].

Disinfection process is the destruction of microorganisms that are found on living or non-living materials and may put human life at risk [45].

At this point, by integrating the disinfection tunnel application, which is also applied today, into the logistics pro-

cess and increasing its use, the hygiene-based contactless logistics process that we have brought to the literature will be supported and the damages of the environmental factor will be minimised.

The disinfection tunnel is a system that enables the delivery vehicles sent to a quarantined area to be sterilized by disinfection. The system is very important both for human health and for preventing the spread of pandemics [46]. The vehicle entering the tunnel gets hygienic in detail with disinfectant liquid that has been cut into small particles [47]. This method used today will prevent the spread of possible epidemic diseases by reducing the effects of human contact, and will have an essential place in the hygiene-based contactless logistics process addressed before.

### **CAROUSELS**

As the automatic storage system, which is divided into two as horizontal and vertical, carousels has movable shelves and rows. In this storage system, loading and unloading operations are carried out by moving racks and rows, eliminating human contact. As carousels have the ability to load-unload automatically with the modular system that can work alone [48], they will reduce the direct contact to zero and reduce the risk of the spread of deadly epidemics, which are still present today, and safeguard human health.

### **SMART CONTAINER SYSTEM WITH DRYING OVEN**

During the cholera epidemic in 1894, serious measures were taken and vital drying ovens started to be used [49]. In fact, the purchase of drying ovens increased and it was planned to make people's clothes sterile by circulating these machines in the neighbourhoods [50].

Drying ovens are a kind of laboratory oven, which are in different volumes, adjustable between 60 and 250 degrees, and airtight. They are used for heating, cooking, and drying in a certain temperature range, and what interests us is that they're also used for sterilising and producing and killing germs. These ovens are commonly used to kill germs and disinfect various materials [51]. Since these machines, which have been frequently used in historical epidemics, are effective in destroying microorganisms, they will be placed in containers in case of any human contact after loading, and will ensure the destruction of microorganisms such as viruses, bacteria, etc. which are present or likely to occur in containers during transport, thus it will prevent possible diseases from spreading.

### **DRONE LOGISTICS**

Reflections of technological developments in the world have also caused significant changes in cargo transportation with drone and have become an important part of the logistics industry. A total of 47% of the world drone market

is classified as civilian drones, and 24% as commercial drones, and the rest include drones created for consumer purposes [52]. Although the use of commercial drones seems to dominate a quarter of the market for now, this rate will increase rapidly in the future with the increase in contactless logistics activities. Logistics is in the process of evolving from traditional transportation vehicles to new generation ones.

Cargo transportation with drones, which will possibly be the most effective of the new generation transportation vehicles, has important advantages such as having lower costs and a faster delivery time compared to other transportation vehicles. In addition, an unnoticed advantage is that it will shorten the procurement process in the COVID-19 pandemic and in the future epidemic situations, preventing the danger of passing the product from hand to hand too much, and minimizing the human factor in the transportation system, thus, it will serve the hygiene-based contactless logistics process.

We believe that drones will be the future of hygiene-based contactless logistics. The plans of customers who do shopping in Reykjavik, the capital of Iceland, to receive food and other products at their doors with drones which significantly shorten the delivery time have gradually started to be implemented in real life. An Icelandic online retailer, Aha, continues its drone delivery service, which started in 2017 with Flytrex, by expanding its service area. With 700 m range and 13 different routes within a year, it has access to almost half of the capital [53].

Many retail and logistics companies around the world are striving to realise this dream. Amazon, Alphabet, FedEx, Uber, and UPS are some of them [54]. Every step to be taken by these and similar companies worldwide to establish the urban drone delivery service will contribute greatly to the hygiene-based contactless logistics system.

## CONCLUSIONS

If the developments during historical pandemics are analysed carefully, it can be observed that change and transformation in many areas take place very quickly. It should not be surprising that similar changes and interactions occur after the COVID-19 global pandemic.

Continuing the sustainability of economic activities by keeping human health at the forefront in our blue globe, where the Atlantic age is questioned and where the Asian age is on the agenda, and where great changes occur, depends on the survival of the logistics sector. The pandemic has become a serious threat to the logistics sector. In this sense, it has a very strategic importance in terms of meeting the needs and ensuring the sustainability of the supply chain.

Undoubtedly, hygiene-based contactless logistics will provide countries and companies with a very important

competitive and superiority advantage in the future. Although the basic understanding of Industry 4.0 is to increase people's quality of life with high technology and innovation, to gain superiority against competitors with the latest technologies and to increase productivity with low costs, it has been determined in our study that an important factor that will seriously threaten itself is unfortunately overlooked. The notion that an unforeseen pandemic would prevent the previously determined objectives from being achieved was missed. In fact, the core of Industry 4.0 was to increase the competitiveness by reducing the use of the labour factor within the industry. However, during the pandemic process, it was seen that reducing the use of the labour factor feeds the concept of hygiene-based contactless logistics as it will increase the hygiene-based contactlessness indirectly and unknowingly. The contactlessness here is closely related to human health.

Serious changes of directions are expected in the global supply chain during and after the COVID-19 outbreak. The worldwide COVID-19 pandemic caused a serious issue of trust on consumers with the fear that the products produced in monocentric Asian countries, especially those based in China, are not hygienic enough. These and similar thoughts will trigger and change the direction of the global supply chain. The companies that want to shift the route of the first wave of goods demands that will come from Europe, Asia and Africa and even beyond the Atlantic to their own countries, have to first rebuild their logistics infrastructures which will respond to the post-epidemic demand explosion on the hygiene-based contactless logistics and the 7+1 rights of logistics (7+ right hygiene) in relation to Industry 4.0. We are of the opinion that this situation will have a historical meaning in terms of the sustainability of the future strategies of countries that have important geostrategic and geopolitical advantages. As the effects of Industry 4.0 on logistics have reshaped what we know, COVID-19 has actually revealed a reality that should have been noticed much earlier. The concept of "right hygiene", which we call the 8<sup>th</sup> right of logistics, should be evaluated together with the opportunities provided by industry 4.0. In the face of all these consequences, we think that the 7 rights of logistics are meaningless and incomplete without the rule of "right hygiene" that we call the "8R".

The crisis environment created by the epidemic has tested the preparations of logistics companies on a global scale and revealed the problems encountered in this area very clearly. Global targets determined for the illumination of vague points that are encountered and not seen in the sector are presented below as suggestions.

### Global goals for the development of sustainable contactless logistics:

- An innovative and robust infrastructure should be built against epidemics by reviewing the entire infrastructure of the sector, and all innovations for hygiene-based con-

- tactless logistics should be encouraged by transitioning to a sustainable logistics process covering every sector;
- National and international logistics regulations need to be updated to support hygiene-based contactless logistics activities and ensure their development;
  - By increasing the capacity of the amount of cargo carried at a time in land, sea and air transportation and by ensuring that more cargoes are carried via fewer vehicles, it should be ensured that transportation costs and environmental pollution, and the risks of spreading contact-based pandemics should be reduced;
  - In order to bring the competitiveness of the logistics sector to the international level, research and development activities should be supported especially for hygiene-based contactless logistics;
  - On a macro basis, international companies, on a micro basis, national companies need to design hygiene-based contactless logistics networks effectively and determine strategic distribution locations;
  - Courses for contactless logistics should be offered in relevant departments of universities and organizations should be developed for contactless logistics;
  - Innovative processes should be followed consistently by creating cities and settlements that comply with the principles of contactless logistics;
  - Large trade ports and existing logistics centres should be re-coordinated and re-designed according to the contactless logistics system;
  - National and international transport corridors (ports and border gates) in active use should be updated with improvement works for hygiene-based contactless transport.

During the COVID-19 process, the world experienced the supply and demand shock at the same time and faced a different crisis that it has never experienced at this scale. In this sense, one of the points that should be considered is that hygiene-based contactless logistics should be evaluated in relation to both supply- and demand-side interactions. If the pandemic process is not managed well all over the world, global economic costs will have to be paid. Every global epidemic on a large scale can be overcome with a struggle on a global scale. Hygiene-based logistics and the 8<sup>th</sup> right of contactless logistics will be one of the most important weapons in this global struggle. Based on Schumpeter's idea of "creative destruction" (1942), "contactless logistics" and "right hygiene", which we define as the 8<sup>th</sup> right of logistics, can be considered as an opportunity during the COVID-19 pandemic process.

We believe that our study on hygiene-based contactless logistics will make considerable contributions to future research on this issue and to the research findings.

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